

**REMARKS**

The Office Action of December 21, 1998 and the *COMMUNICATION* of October 26, 1999 were received and carefully reviewed. Reconsideration and withdrawal of the currently pending rejections are requested for the reasons advanced in detail below.

Claims 24-58 were pending prior to the instant amendment. By this amendment, claims 24, 32, 38, 41, 47, 50, and 56 are amended, and new claims 59-63 are added to recite additional features of the present invention to which Applicants are entitled. Consequently, claims 24-63 are currently pending in the instant application.

Initially, Applicants wish to inform the Examiner that an *Information Disclosure Statement* was filed on December 29, 1998. The undersigned received a Patent Office mail room stamped receipt card evidencing receipt of the IDS of December 29, 1998 on January 11, 1999. Therefore, it is respectfully requested that the Examiner evidence consideration of the references cited in the IDS by providing Applicants with a copy of the initialed Form PTO-1449 filed with the IDS of December 29, 1998 with the next Official Action.

Addressing the Section 112 rejections, claims 24-40, 47 and 56-58 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claims 24 and 32 are amended herein to properly include "steps of" in the preamble of these claims to provide antecedence specific steps referred to in later claims. Claims 38 and 47 are rejected as being confusing and ambiguous because the claims allegedly contradict the independent claims 32 and 41, respectively, from which they depend. Although claims 32 and 41 recite that the catalyst material is not added to a second portion of the amorphous semiconductor film, these claims provide that crystal growth proceeds from the first portion to the second portion in

a lateral direction during the recited first heating. During this lateral growth, the catalyst material migrates from the first portion to the second portion, thus the catalyst material is contained in the second portion. The specification clearly supports this catalyst material migration on page 13, lines 10-25. (See, also, page 21, lines 4-9.) Consequently, this aspect of the rejection should be overcome.

Claim 56 is also rejected for including the article "a" before the recitation of "crystallinity." Claim 56 is amended accordingly to overcome this rejection.

With respect to claims 31, 40, 49, and 55, the Examiner contends that these claims are confusing and contradictory because "one cannot promote further crystallization by melting what's already there!" As the Examiner notes on page 3 of the Office Action, the first heating must be assumed to produce incomplete crystallization. As a result, the irradiating step to promote further crystallization of the crystallized semiconductor film could certainly take place if portions of the film are not crystallized. This is clearly supported on page 18, lines 4-7 and even more specifically on page 20, lines 3-24 of the specification, where the irradiation step are explained in greater detail.

The surface of the film may also "melt" to provide enhanced crystallization, since there are various degrees of crystallization, e.g. microcrystalline, polycrystalline, etc. As a result, claims 31, 40, 49 and 55 should be considered allowable under Section 112, second paragraph.

Claims 56-58 are rejected under 35 U.S.C. §112, first paragraph, because the specification is allegedly enabling for crystallization using a catalyst and does not provide enablement for crystallization that does not include a catalyst material. The rejection is traversed for the reasons advanced below.

Specifically, Applicants contend that the claims including use of the catalyst material, that is claims 24-55, are directed to one aspect of the present invention,

while the claims 56-58 are also another aspect of the present invention. As noted by the Examiner, the specification provides on <sup>7777</sup>page 12, lines 9+ that Figure 8 includes a sample that does not include Ni. Page 13, lines 1-9 also provides that electron microscope analysis shows that laser light irradiation is effective in improving the crystallinity of the Si film. This is not limited only to films including the catalyst material, and, thus, can be interpreted to include Sample 6 of Figure 8. X

More importantly, this is not, however, the "only" reference in the specification relating to the formation of a semiconductor device without using a catalyst material, as contended by the Examiner. A careful review of the specification provides examples of additional express disclosure of the formation of a semiconductor device using the method of the present invention without the use of catalyst material. On page 40, lines 17-25, it is disclosed that laser irradiation and heat treatment are an aspect of the present invention without any reference to the use of a catalyst material. Even more compelling, however, is the disclosure on page 43, lines 13-15 and page 43, line 27 to page 44, line 2 of the specification where it is expressly disclosed that the nickel element may be introduced selectively only into the silicon film of the TFTs that will constitute the peripheral circuit area and not in the TFTs that will constitute the pixel area, which are formed "by not using a metal element." (See, page 43, lines 13-15) Therefore, claims 56-58 are clearly enabled by the specification of the instant application. —

Cases have held that "if a claim adequately defines patentable subject matter and meets the disclosure and clarity standards of Section 112, then it is proper, even though it may encompass less than what the invention could claim." *Andrew Corp. v. Gabriel Electronics, Inc.* (Fed.Cir. 1988). Because the catalyst is not used in every embodiment disclosed in the specification, the claims should be considered enabled by the disclosure, since one of skill in the art would surely understand how

← Ni.  
Cat.

to perform the disclosed process leaving out the step of providing a catalyst element as taught by the specification.

Claims 24-58 are rejected under 35 U.S.C. §112, first paragraph, for containing new matter. Specifically, the Examiner contends in paragraph (4) of the Office Action that the specification fails to teach an open ended temperature range for the second heating step and fails to teach annealing the crystallized Si film in a hydrogen atmosphere.

With respect to the temperature of the second heating in claims 24, 32, 41, and 50, Applicants believe that it is not necessary to recite the maximum temperature limitation in the claims, since the upper limit is dependent upon the substrate material, as provided on page 11, lines 6-10, rather than accomplishing the purpose of the heating step. The recited lower limit is, however, provided as the more critical limitation for obtaining the desired reduction of defects in the film. Higher temperatures than those provided in the specification could also provide such reduction in the present invention, but are limited only by the substrate used, not the overall defect reduction accomplished by heating.

The specification need not describe the claimed invention in ipsis verbis to comply with the written description requirement *Ex Parte Sorenson*, 3 U.S.P.Q.2d 1462, 1463 (Bd.App.&Int. 1987). As a result, the claims should be considered acceptable in this regard.

With respect to the hydrogenation step, embodiment 4 discloses the hydrogenation after the second heat treatment. Although this hydrogenation step is not performed immediately after the second heat treatment, there is nothing in claims 24, 32, 41 and 50 that requires that the annealing in the hydrogen atmosphere occur directly after the second heat treatment for reducing defects. These claims merely recite that the semiconductor film is annealed in a hydrogen

P. 7-26  
"heat treatment"  
"hydrogenation"  
"step"  
"the"  
"the"

P. 26-  
"heat treatment"  
"hydrogenation"

P. 29-  
"deposited Al film"  
"anodic oxidation"  
"implant impurities"  
"the H<sub>2</sub> anneal"  
P. 26-  
"the heat treatment"  
"the SiO<sub>2</sub> film"  
"the patterned Si film"  
"the oxide to form Si<sub>3</sub>N<sub>4</sub> film"  
"the nitride Si<sub>3</sub>N<sub>4</sub> film"

atmosphere after the second heating. Applicants use of the "and then" language merely further emphasizes that the annealing should be interpreted to occur after the second heating.

Specifically, as provided on page 27, line 19, after "the above crystallization step by heat treatment," the crystallinity of film is enhanced by irradiation with light, then a heat treatment is performed to reduce defects (page 28, lines 5-6) and then annealing is performed in a hydrogen atmosphere (page 30, lines 14-16). Therefore, embodiment 4 provides a heat treatment for crystallizing, followed by an irradiation with light to enhance crystallization. As a result, embodiment "1" is not the only disclosure of separate crystallization steps, followed by annealing in a hydrogen atmosphere, as provided by the Examiner. The fact that additional processing steps are performed in between these last two recited steps should not affect Applicants ability to broadly claim the invention, for the reasons advanced above.

Furthermore, Applicants contend that the steps described in the embodiment 2 can be applied in the embodiment 4, for example, as shown in the specification on page 26, line 13. Since the embodiment 2 comprises the step of heat treatment before irradiating, Applicants contend that the above claims are further supported in the specification.

Also, the Examiner asserts that the hydrogenation of the silicon film is a New Matter, since none of the deposited and treated silicon film are disclosed to be treated by the hydrogen containing atmosphere. However, the purpose of the heat treatment in an atmosphere comprising hydrogen is hydrogenation of the silicon film itself, even though other fabricating steps, for example patterning, gate forming, doping and so on, are interposed between the second heat treatment and the hydrogenation step. The semiconductor film would still be annealed during the

"last" step noted by the Examiner in the hydrogen containing atmosphere. As a result, Applicant contend that this added step is fully supported by the specification.

Claims 31, 40, 49 and 50 are also rejected for containing new matter for reciting "melts.". Although the word "melt" does not appear to be expressly used in the specification, the meaning of the word "fuse" is clearly "melt" as shown in Webster's Dictionary on page 925, line 20 (attached). Consequently, recitation of the term "melt" should not be considered new matter.<sup>1</sup>

For the above reasons, Applicants contend that the currently pending claims should be considered allowable under Section 112.

Claims 24-58 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ohtani et al. US 5543352, in view of Zhang et al 5529937, or in view of Liu et al (826) or Zhang et al (291). Applicants intend to overcome this rejection based on Ohtani et al. US 5543352 (filed on November 16, 1994) by submitting a verified English translation of the priority document No. 6-225851 filed on August 26, 1994.

Applicants are currently preparing and will submit the aforementioned translation of JP 6-225851 as soon as it is received by the undersigned.

New claims 59-63 are added to recite additional features of the present invention and recite the maximum temperature limitation for the second heating step. Support for this recitation is provided in the specification beginning on page 1, line 22 and following throughout the specification in the examples when referring to heat considerations of the substrate to prevent bending, damage, etc.

In view of the foregoing, it is respectfully requested that the rejections of record be reconsidered and withdrawn by the Examiner, that claims 24-58 be

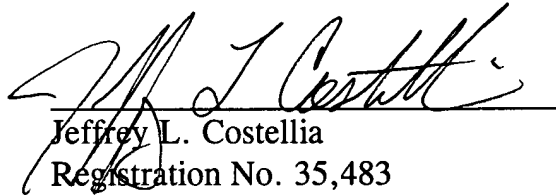
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It is noted that the Examiner objected to the term "fuse" in the Office Action of May 26, 1998.

allowed, that new claims 59-63 be allowed and that the application be passed to issue. If a conference would expedite prosecution of the instant application, the Examiner is hereby invited to telephone the undersigned to arrange such a conference.

Respectfully submitted,



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